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DEPARTMENT OF THE TREASURY

WASHINGTON, D.C. 20220

December 13, 1983

Memorandum To: Members of Task Group 6

Subject: Procedure for Estimating Supply and Demand in ROW

From: Hazen F Gale

The attached paper and tables describe a procedure for estimating the supply and demand for strategic materials in the rest of the world (ROW) using chromium as an example. The excess supply after the ROW demands are satisfied would be available for U.S. imports. This is task 6 in the original outline.

Would you please review the method, the various assumptions and the chromium table for concept, logic, and reasonableness and provide comments to me. I would like to schedule a meeting early in the week of December 19 so we can go over the comments which will be used to revise the methodology as necessary before going ahead for the rest of the 21 important materials in the stage I list.

You can call me (566-2561) or Don Niewiaroski (566-8587) for clarification or background on the paper.

Attachments

Richard Levine - NSC
Ken Glozer - OMB
Maurice Ernst - CIA
Warren Farb - Commerce
John Morgan - Bureau of Mines
Ed Zabrowski and Douglas Scot - FEMA
David Tarbell - DOD
Lincoln Anderson - CEA

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Review of Strategic Stockpile Goals:
Estimation of Foreign Supply and Demand
During Mobilization and War

Purpose

A major consideration in determining stockpile goals for
strategic materials is the availability to the U.S. of materials
from world markets which in turn depends on demand and supply
conditions in other countries. Although the U.S. undoubtedly
could by various means gain access to virtually the total
non-communist supply, it seems reasonable that other countries
will need a certain minimum of these materials to enable
effective operation of their economies. The difficult task is
to determine an equitable sharing of the available free world
supply. This paper describes a procedure for estimating an
equitable demand reduction in the rest of the world which then
would determine the amount of supply that might be available
to help meet U.S. needs.

The first effort will be confined to 21 major minerals
in the attached list. An example using chromium is shown in
the attached tables: (a) Supply, (b) supply-demand balance,
and (c) consumption.

Objective

The immediate objective of this task is to develop a
supply-demand balance sheet for a mobilization period relying
on supply estimates from the Bureau of Mines and demand
estimates using past consumption data, probable war damage,
and various price elasticities.

Procedure

The general procedure is to adjust the Bureau of Mines'
world production estimates in table (a) to exclude Soviet Bloc
supplies, politically unreliable supplies and shipping losses.
Estimated consumption in the U.S. will come from the
domestic requirements task group. The potential consumption
for the rest of the non-communist world in table (c) is estimated
to be at the peak pre war level. The latter is adjusted to
exclude lost demand due to war damage in certain war zones.
Then demand is further reduced, in response to high prices or
some other demand rationing device. This last calculation
is critical in determining how the burden of adjusting to
the supply constraint is spread among the U.S. and other
non-communist consumers. Finally, the quantity available to
the U.S. from allies and other non communist areas is the
difference between the supply and demand estimates for ROW
shown in table (b).

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Supply estimates (table a) were developed for each major pro-
ducer and for the world by the Bureau of Mines. These represent
capacity that could be brought on stream at significantly higher
prices (about 50% over 1978-82 average prices for common materials).
Production is the only source of supply; commercial stock drawdowns
have been ignored here but they might be an important source in
the U.S. for some materials. In estimating availabilities to the
U.S. and the rest of the world (ROW), these supply estimates were
adjusted to exclude production by the Soviet bloc and China since
those supplies would not be available to the West. U.S. supplies
also were deducted from the world total because all of those will
be used to meet U.S. requirements. As described below, the U.S.
supplies also were deducted from U.S. consumption.

Political reliability. World supplies are further reduced
by unreliability of some supplies. The prototype table includes
ad hoc assumptions about supplies lost to this factor, but the
final estimates would rely on the results of the task work on
political reliability.

Shipping losses. These also are to be deducted from the
total in determining the supply available to the U.S. and ROW.
The prototype table includes estimates based on work by other
task groups, primarily energy. The assumption is that
shipping losses will average 6% in the first war year, 3% in
the second year, and 1% in the third year. We have found no
evidence to indicate that losses for individual commodities
would be significantly different. Also, there is no
differentiation of shipping losses destined for the U.S.
as opposed to ROW.

Consumption estimates (table c). Ideally, consumption
projections should be made in much the same manner as those for
the U.S., i.e., estimate requirements for specific materials to
operate an economy at a full mobilization level or (for non-
combatant countries) consistent with world economic activity.
This obviously cannot be done with any accuracy because of the
lack of data, comprehensive economic models, or likely participation
of each country in the war effort. The practical procedure which
has been adopted is the use of peak consumption in the pre-war
period. In most cases 1980 seems to be the peak year, but for
certain commodities and countries peaks were attained in other
years. If there is good reason to specify higher (or lower)
consumption during war years those estimates can be easily
substituted.

In the case of the U.S., domestic supplies are deducted
from U.S. consumption under the presumption that they will
be used only in the U.S., thus reducing U.S. demands on
supplies from the rest of the world.

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War damage to demand is an estimate of reduced demand in certain countries because of damage to industries from military activities in the war zones. Industrial capacity is presumed to be completely destroyed in some countries and reduced significantly in others in Western Europe and Asia. The proportional reductions are the same for all materials and roughly consistent with the estimate of war damage used by the energy task group. More precise estimates for individual materials might be possible in a few cases but these would depend on information regarding use of materials by particular industries and the geographic location of these within those countries in the war zones. That information is not readily available.

Net demand after war damage reflects the amount of material that would be consumed at the base period price if the supply were available. Since supply will usually be less than demand, price will have to rise to ration the supply. The amount of the necessary cutback in demand is the difference between the supply available to the U.S. and ROW and the net demand after war damage. This difference is shown in the addenda item "required demand reduction." The percentage reduction in demand is in parentheses.

Demand impact is an estimate of the reduction in demand in response to high prices that are expected to accompany the high demand and limited supply situation during wartime. The exact prices are not necessary in allocating the demand reduction, but it was thought useful to make some estimates (see addenda). These price estimates varied significantly depending on the price elasticity for each major consuming country and its relative share of total consumption. Several aggregate elasticity estimates were constructed based on assumed elasticities for three major areas: (1) the U.S., (2) other allies, and (3) other non-communist countries; these also are shown in the addenda. Three sets of elasticities were weighted by the distribution of "peak demand" in each war year. The following illustrates the procedure:

	Elasticities			Distribution of demand	Weighted elasticities		
	1)	2)	3)		1)	2)	3)
U.S.	0	-.2	-.5	53.8	0	.108	.269
Other allies	-.2	-.2	-.5	32.1	.064	.064	.161
Other non communist	-.4	-.2	-.5	14.1	.056	.056	.141
Total				100.0	-.120	-.228	-.571

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The weighted elasticities were used to develop a percentage distribution of the demand reduction among major areas (U.S., allies, and other non communists) to bring consumption into balance with available supplies.

The assumed elasticities are critical to the sharing of the burden of demand reduction because the selection will determine whether the U.S. bears the full bruden (when non-U.S. elasticities are zero) or none of it (when the U.S. elasticity is zero).

The total reduction in demand was allocated according to the percentage distribution of weighted elasticities as described above. However, only those parts allocated to non-U.S. areas were deducted from total demand because the U.S. domestic requirements presumably already reflect the elimination of non-essential uses through response to high prices. It should be noted that as the burden of demand reduction on non-U.S. areas increases, the size of U.S. stockpiles is reduced.

Net demand on ROW supplies. This estimate is derived by deducting the demand reduction from net demand after war damage. This includes U.S. demands plus those from allies and other non-communist areas. This total actually overstates actual demand because U.S. imports will be smaller by the amount of withdrawals from its stockpiles or commercial inventories.

To determine demand in ROW (outside the U.S.), U.S. demand was subtracted from total demand.

Finally, the supply-demand balance (table b) in ROW is simply the excess of ROW supplies over ROW demand. This balance is the amount available for U.S. imports. Also, as the availability of these imports increases, the necessary U.S. stockpiles are reduced.

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1/ For three-year, two-front global war (scenario x). For many commodities and countries, 1980 is the pre-war peak consumption year; 1982 is most recent base year; 1983 is warning or mobilization (M) year; 1984 (W-1), 1985 (W-2), and 1986 (W-3) are the three war years. ROW refers to countries other than U.S., China and Soviet Bloc and includes allied countries plus other non-communist areas.

2/ Soviet Bloc (excluding China) is excluded because its supply and consumption will be isolated from supply and consumption of the rest of the world (ROW). China is excluded because its supplies are not expected to be available to ROW or the U.S; its imports are expected to be minimal during war time.

3/ Assumed no withholding for political reasons during year M. Then assumed that supplies in war years would be denied as follows: Iran, 100%; Finland, 50%; India, 50%; South Africa, 50%. (These will be revised later consistent with the task group's findings on political realiability.) (S)

Shipping losses were assumed to be 6% in W-1, 3% in W-2, 1% in W-3 which corresponded roughly to the 3% average which has been agreed for general shipping losses. It is assumed here that the total supply would have to be shipped by water.

4/ U.S. production is deducted from both supply and consumption because it is assumed all U.S. production will be used to meet U.S. requirements.

5/ Net demands on ROW supplies in years, M, W-1, W-2, W-3 are the sum of individual areas listed below. Consumption is assumed to be consumption in its peak pre-war year. U.S. consumption is arbitrary in this example, but will later be the estimate of U.S. domestic requirements being estimated by a separate task group.

6/ Includes all of Western Europe except Greece, Ireland, Portugal, and Switzerland. Sweden is a major consumer in "other W. Europe" (226,000 tons in 1979).

7/ Percentage decreases in demand caused by war damage are similar to estimates used in energy study; FRG and Korea - 100% in all three war years; rest of Europe -15%, -13%, and -8% in the three war years; Japan -7%, -6%, -5% respectively. (S)

8/ The shortfall in supply (see required demand reduction in addenda) was allocated among U.S., other allies, and other non communist on the basis of weighted (by world demand shares) elasticities. The allocations varied in each year but for war years were approximately: U.S., 45%; other allies, 30%; and other non communist, 25%.

9/ The reduction in demand which is necessary to make demand equal supply in part (a); the percentage reduction is in parentheses.

10/ These are estimated prices using the percentage reductions in demand (see 9/) and the elasticities (e) shown. The latter were estimated by weighting elasticities for each area by its share of demand in each year. Three alternative sets of assumed elasticities for U.S., allies and other non communist were tried: (1) 0, -.2, -.4; (2) -.2, -.2, -.4; (3) -.5, -.5, -1.0. Weights were the same for all three sets in each year; approximate weights were .53, .33, and .14 respectively.

11/ Prices used by Bureau of Mines in developing world and country production estimates.

Source: Basic supply and consumption data for 1980 and 1982 and supply projections for 1983-86 were compiled by Dept. of Interior. Consumption projections and estimated losses due to various causes were estimated by Dept. of Treasury.

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List of 21 Strategic Materials

Aluminum Metal Group

Bauxite, Refractory

Beryllium Metal Group

Chromium, Chemical & Metallurgical Group

Cobalt

Columbium Group

Copper

Flourspar, Acid Grade

Flourspar, Metallurgical Grade

Lead

Manganese, Chemical & Metallurgical Group

Molybdenum Broup

Nickel

Platinum Group Metals: Iridium, Palladium, Platinum

Rubber

Tantalum Group

Tin

Titanium Sponge

Tungsten Group

Vanadium Group

Zinc

Chromium: Estimated Foreign Demand 1/
(Thousand tons)

	1980	1982	M 1983	W-1 1984	W-2 1985	W-3 1986
Consumption (Part C)						
Total	2966	2612				
Less: Soviet Bloc	-568	-687				
China	0	0				
Net of Soviets and China 2/	2398	1925	4079	4079	4079	4079
Less: U.S. production 4/	-53	-48	-60	-60	-65	-70
Net demand on ROW supplies	2345	1877	5/ 4019	5/ 4019	5/ 4014	5/ 4009
U.S. (nondomestic sources)	479	223	5/ 1940	5/ 1940	5/ 1940	5/ 1940
Western Europe 6/	913	(739)	1098	1098	1098	1098
FRG	(298)	(197)	(330)	(330)	(330)	(330)
Other W. Europe	(615)	(742)	(768)	(768)	(768)	(768)
Canada	28	8	28	28	28	28
Australia	17	8	17	17	17	17
Japan	471	387	495	495	495	495
Korea	6	3	10	10	10	10
All other non communist	431	509	509	509	509	509
Less war damage 7/	0	0	0	-490	-460	-416
Net of war damage	2345	1877	4097	3607	3637	3671
Less demand impact outside U.S. 8/	0	0	-774	-1013	-813	-617
Net demand on ROW supplies	2345	1877	3323	2594	2824	3054
Less U.S. requirements	-479	-223	-1940	-1940	-1940	-1940
Net demand ROW	1864	1654	1383	654	884	1114
Addenda:						
Required demand reduction 9/			-1335(33%)	-1913(53%)	-1534(42%)	-1143(31%)
Price per ton 10/ a) e = -.12			$750	$1083	$900	$717
b) e = -.23			487	661	565	470
c) e = -.57			316	386	347	309
d) BOM 11/	201	207	250	300	300	300

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Chromium: Estimated Foreign Supply-Demand Balance 1/
(Thousand tons)

	1980	1982	M 1983	W-1 1984	W-2 1985	W-3 1986
Supply (Part A)						
Total	3066	2610	4132	4332	5259	6215
Less: Soviet Bloc	-1102	-1117	-1310	-1510	-1811	-2111
China	0	0	0	0	0	0
Net non communist production 2/	1964	1493	2822	2822	3448	4104
Less: Politically unreliable 3/	0	0	0	-960	-1215	-1480
Net reliable supply	1964	1493	2822	1862	2233	2624
Less: Shipping losses 3/	0	0	0	-108	-65	-26
Net available to U.S. and ROW	1964	1493	2822	1754	2168	2598
Less: U.S. production 4/	-53	-48	-60	-60	-65	-70
Net available to ROW	1911	1445	2762	1694	2103	2528
Supply-Demand Balance (Part B)						
U.S. and ROW						
Supply	1964	1493	2822	1754	2168	2598
Consumption	2398	1925	3383	2654	2889	3124
Balance	-434	-432	-561	-900	-721	-526
ROW						
Supply	1911	1445	2762	1694	2103	2528
Consumption	1864	1654	1383	654	884	1114
Balance (available for U.S. improts)	47	-209	1379	1040	1219	1414
U.S.						
Supply (domestic)	53	48	60	60	65	70
Imports	454	229	1379	1040	1219	1414
Requirements	532	271	2000	2000	2000	2000
Balance from stockpile	--	--	561	900	716	516

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